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The American Fertilizer

Vol. 99 SEPTEMBER 11, 1943 No. 6

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See page 27

...THE...

AMERICAN FERTILIZER

"That man is a benefactor to his race who makes two blades of grass to grow where but one grew before."

Vol. 99 SEPTEMBER 11, 1943 No. 6

Fertilizers and Food Production

By FIRMAN E. BEAR*

WHEN, a century ago, Justus von Liebig first tried his new "mineral manures" on some "barren, sandy land" near Giessen, Germany, even his scientific vision could not have foreseen the enormous industry which was to spring from that test. Almost from that day forward interest in these wonder-working minerals began to grow until today they are literally being spread over all the earth. So important have some of the less abundant of the raw materials of the mineral-manure industry become in the agricultural economy of the world that, in time of war, the nations in control of the sources of supply have a highly important weapon at their disposal. Witness, for example, the military significance attached to the phosphate deposits on the Island of Nauru in the Pacific, still under the precarious protection of Japan, and to those in Tunisia on which the nations of Southern Europe had, until recently, so largely relied.

In America, millions of acres of relatively new land have not yet felt the magic touch of fertilizer. Each year, however, a few thousand more of our farmers have their eyes opened to the possibilities in its use. The experiences of these new recruits, added to those of the long-time users of mineral manures, serve continually to renew the confidence on which the fertilizer industry is built. Thus, almost every farmer in the older agricultural areas finds strips of land in his fields on which the crops are dwarfed because of the failure of the fertilizer drill to do its work properly. Any spring skepticism on his part as to the value of fertilizer, therefore, is annually dispelled long before autumn arrives.

United States Used Thirty Million Tons Mineral Manures in 1943

In 1942, fertilizer consumption in continental United States reached an all-time high of over 10 million tons. During that year an additional 18 million tons of liming material was applied to the soils of this country. Thus the total application of mineral manures amounted to around 28 million tons. In terms of 25-ton cars, this tonnage would require a train extending from New York to San Francisco, back again to New York, and on out a second time to a point 100 miles beyond Denver, Colorado, without considering the space required for the engines, tenders, couplings, and cabooses. The records for 1943 are expected to show a 10 per cent increase over those for 1942, and an additional 10 per cent will probably be added to the tonnage next year. The total consumption of mineral manures in 1944, therefore, may well be 33½ million tons, and the length of the theoretical train will have been extended another 1000 miles.

The general trend in the use of mineral manures is upward, the nation over, and it is likely to continue in that direction more or less permanently, even after the war is won. The extra food needs arising out of the present world conflict call for the drawing of enormous drafts against the natural stores of fertility in the soils of the Central West where fertilizers play a much less important part in crop production than they do farther east. Out of the pressure to produce also

* Journal Series paper of the New Jersey Agricultural Experiment Station, Rutgers University, Department of Soil Chemistry and Microbiology. Presented before the Fertilizer Division, American Chemical Society, at Pittsburgh, Pa., September 7, 1943.

grows a certain carelessness in the management of the land as a result of which erosion takes a heavier-than-normal toll of the soil. Thus the area in need of lime and fertilizer is constantly being enlarged, while the amount required to raise crop yields to more economic levels in the older agricultural regions never grows less. When world peace has come again, marginal farming on the poorer land is likely to lose out in the competitive struggle with intensive agriculture, as practiced on the better soils of this country, and greater expenditures for mineral manures for each acre of cropped land will be the natural outcome.

Greatest Intensity in Use of Mineral Manures Along Atlantic Coast

It is along the Atlantic Seaboard, where the land cannot readily be made to produce enough to feed the people of the region, that we get the clearest concept of our dependence upon the mineral-manure industry. In New Jersey, with an estimated 878,000 acres of harvested crops in 1942, the consumption of lime and fertilizers amounted to nearly 740 pounds an acre of cropped land. Many of our farmers now think of soil merely as standing room for plants while they are being "fed" with fertilizers. In fact, the now nearly sterile coastal-plain sands of the Garden State may ultimately be brought under intensive production on a large scale by applying the principles of the soilless-culture system of growing plants.

The farmers of New Jersey have pioneered in fertilizer practice. Forty-five years ago, when the first edition of Voorhees' *Fertilizers* was published, the better potato growers of the State were already credited with using a ton of fertilizer an acre. Since then, successive waves of interest in new materials and methods have developed and spread westward. Thus pioneering work has been done on band-placement of fertilizer, plowing fertilizer under, dropping it on the bottom of the furrow at plowing time, placing it down still more deeply by the use of a sub-soil chisel, and applying it in liquid form, both as "starter" and "booster" solutions. Of the fertilizer problems with which our farmers are now concerned, those involved in the use of trace elements and in the production of crops on the sandier types of soil are among the most important.

On June 2, 1943, representative samples of alfalfa were harvested from two portions of a 12-acre field of sassafras loam soil in Cape May County, New Jersey. One of these samples was selected from a one-half-acre area to which 10 pounds of borax had been applied on May 5 of the previous year. The other was a composite sample from the remainder of the field. The luxuriant dark-green plants from the borax-treated plot yielded at the rate of over 3600 pounds of hay an acre, whereas the dwarfed, disease-infested alfalfa covering the remainder of the field yielded only a little over half that amount. Since that date, similarly spectacular results have been obtained from seven other alfalfa fields located on sassafras soils in South Jersey.

We knew, before the borax was used, that the soil in the first-mentioned field contained only 0.15 p.p.m. hot-water-soluble boron, whereas the content of this element should have been at least 0.35 p.p.m. dry soil, judging from our experience on this point. Our failure to apply our laboratory findings to the whole field, rather than to a mere half-acre plot, cost that farmer more than 10 tons of excellent alfalfa hay having a net value of at least $200. What his total loss will be, before the borax application made more recently to the rest of the field can accomplish its purpose, remains to be determined.

Of some 450 field tests of borax that were conducted on the most important soils and crops of New Jersey in 1942, plant response was revealed by mere inspection in 12 per cent. This percentage would probably have been larger except for the fact that much of the fertilizer used by the farmers contained five or more pounds of borax a ton that had been added at the factory. No doubt a considerable number of additional cases of improvement in the quality or yield of the test-plot crops occurred that the unaided eye could not detect. The most important point involved in this statement concerning boron, however, is that deficiencies of this element are so widespread in New Jersey that we can no longer ignore the need to apply it. This is particularly true, now that we are striving to prevent a lack of food from being a limiting factor in winning the war. Whether all fertilizer to be sold in the State should be made to contain borax, or whether this material should be applied separately as needed, remains to be determined.

Some Coastal-Plain Soils Show Need for Extra Magnesium

More recently we have come to believe that a lack of available magnesium may be a more seriously limiting factor in crop production in New Jersey than was formerly thought to be the case. A current greenhouse study of 20 of our most important soil types,

using alfalfa as an indicator crop and applying magnesium sulfate at the rate of 80 pounds magnesia (MgO) per acre, resulted in yield increases on seven of them that amounted to from 10 to 36 per cent for the first harvest. These soils, in the order of the yield increase, were sassafras sand, Merrimac silt loam, Hagerstown loam, Lakewood sand, Gloucester stony loam, Penn silt loam, and sassafras loamy sand. For the first three harvests, the average increase in yield from the use of magnesium sulfate on these seven soils has been 16 per cent.

Here, again, we are skeptical of our laboratory and greenhouse data, so these tests are being checked by field trials. Presumably many farmers are supplying enough magnesium in the form of the dolomitic types of liming materials to meet the needs of their crops for this element. But it seems probable that with magnesium, as with most of the other elements required by plants, additional supplies, *added in the form and manner of fertilizers*, may materially increase crop yields in many cases.

Storage Capacity for Nutrient Elements a Limiting Factor in Sandy Soils

A lack of ability to store nutrient elements is a seriously limiting factor in crop production on the sandier soil types of the coastal-plain area. Calculated in terms of calcium, and at a pH value of 6.5, the exchange complex of the Ap horizon of a typical sassafras or Lakewood sand has a storage capacity of only about 500 pounds an acre. In many cases, heavy annual dressings of nitrate of soda have raised the pH values of such soils to the optimum without increasing the content of essential elements in the exchange complex.

Another closely related problem is that of the low pH soils of the potato-producing areas. The calcium-storing capacity of a typical sassafras loam soil, at pH 5.2, is around 1200 pounds an acre to plow depth. We are uncertain whether this calcium is yielded up at a sufficiently rapid rate to meet the needs of a rapidly growing potato crop. But the grower applies a ton or more of fertilizer an acre, repeating this dose year after year. If his fertilizer is of the standard 5–10–10 type, it carries about 400 pounds of calcium, and possibly some magnesium as well. In other words, for soils that are farmed at low pH values, considerable dependence is probably being placed on the calcium supplied by the fertilizer. It is an interesting fact that high-acre yields of such a crop as alfalfa, which is very high in its calcium requirements, can be produced at low pH levels on liberally fertilized potato soils.

Two Plow Depths of Intensively Farmed Soils Need Liming

For the heavier types of soil, and for those crops which grow best at the higher pH levels, the liberal use of liming materials affords the best answer to the problem of supplying the calcium needs of plants. Most of the podsolic soils are naturally acid and need liming. Of the 20 soils previously referred to, 13 were found, in their virgin state, to have pH values that were less than 5.5 throughout their profiles. If such land is to be farmed intensively, consideration should be given to the lime needs of about two plow depths of soil. This calls for plowing lime under as well as applying it on top of the seedbed. If we assume that the optimum pH value for most crops is around 6.5, the accumulated lime requirement of the cropped soils of New Jersey, on this basis, is equivalent to over two million tons of limestone. The yearly replacement needs alone are at least 250,000 tons, or twice the amount now being applied.

More Than Three "Plant Foods" May Be Needed in Fertilizers

The need for extra boron, magnesium, and calcium is mentioned by reason of its bearing on the question as to whether fertilizers should be rated only in terms of the quantity and quality of their nitrogen, phosphoric acid, and potash, or whether credit should also be given for their content of certain other essential elements. In proportion as soils grow older agriculturally and as crop production is forced to higher levels, deficiencies are likely to develop in the soil supplies of a considerable number of mineral nutrients. That being so, it would seem desirable to establish for "complete" fertilizers certain minimum percentages below which some or all of these supplemental elements would not be allowed to fall, particularly in those mixtures that are intended for use in the older agricultural areas, on the sandier soils, or on those whose pH values must be kept at low levels for disease-control purposes.

We realize that a considerable item of expense is involved in guaranteeing definite amounts of such supplemental nutrients as may need to be added to fertilizers. We also appreciate that applying these more nearly "complete" mixtures to soils that are already supplied with boron, magnesium, calcium and

(Continued on page 18)

Organic Matter
The Life of the Soil

By H. R. SMALLEY

Director of Soil Improvement Work, National Fertilizer Association, Washington, D. C.

AT THE outset it may be desirable to define just what we mean by "humus." It is the result of the decay of plants and animals. Straw, stalks, leaves, and so forth are organic matter, but not humus. When these materials decay, so that you can no longer tell what they were, they become humus. Animal manures are not humus, but they become humus quickly when applied to the fields. Stated in a little different way, humus is that part of the soil that is the result of plant and animal decay, as distinguished from the mineral portion, which is the result of the breaking down or decay of rocks.

Organic matter, a term much used by agronomists, is a broader term than humus. Any kind of plant material, alive or dead, decayed or undecayed, is organic matter: hence it is a more convenient term than humus in many cases.

I shall try to answer three questions: (1) Why do we want humus in the soil? What does it do that makes it so valuable? (2) Why did our soils lose a large part of the humus they once contained? (3) How can we build up the supply of humus in our soils and use it to the best advantage?

The Purpose of Humus in the Soil

Let us consider the first question, "*Why do we want humus in the soil?*" First of all, humus is necessary to give the soil a good structure, to make it easy to cultivate, to make it loose and crumbly so water and air can move freely. Humus makes a heavy soil lighter and a light sandy soil heavier. It makes all soils absorb water faster, thus preventing run-off and erosion, and it also increases their capacity to hold water. These facts, I understand, have been clearly established in your district during the past spring.

Organic matter in the soil feeds the bacteria and other microscopic soil organisms which are such an essential factor in fertility. It provides the energy necessary for their growth. In growing they take up nitrogen, phosphorus, potassium, calcium, and other plant foods, making these elements more available to crops, at the same time preventing their loss from the soil.

Humus in the soil combines with the plant foods, particularly with nitrogen and phosphorus, thus preventing loss of nitrogen through leaching, as well as holding the phosphorus and other mineral elements in forms available to crops.

In fact, practically all of the nitrogen supply in the soil is in combination with humus with the exception of the relatively small portion which is present in the form of nitrates.

The Loss of Humus From the Soil

Now our second question is, "*Why did our soils lose a large part of the humus they once contained?*"

If my history is correct, the white man took possession of Oklahoma in a big way in 1889, although I am told that some of you came a little *sooner*. For thousands of years before that, your soils were growing grasses and trees. In fact, unless it is disturbed by man, nature always tries to cover the soil with a blanket of vegetation and succeeds pretty well wherever there is some moisture and where the soil contains even a moderate supply of plant food.

But when the forests are cleared away and the land plowed and cultivated or when the prairie sod is broken up, then we have rapid loss of organic matter or humus, and, paralleling that loss, we have erosion. Erosion is not new; it has followed civilized man like a plague for centuries. It was a problem in the eastern states in colonial days. It followed the covered wagon, and finally its destruction became so great that we rather suddenly realized, about ten years ago, that soil erosion

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*From a talk given at the annual meeting of the Arkansas-Berdigris Soil Conservation District, Broken Arrow, Okla., August 13, 1943.

was beginning to threaten our national existence. Here I want to pay tribute to the man who, more than anyone else, was responsible for our awakening—for the movement that in ten short years has made us thoroughly conscious of the dangers of soil erosion, and who has built up a working organization which makes it possible for you and for hundreds of other communities in this country to do something practical about stopping this waste and improving your land. It is scarcely necessary to mention his name—you know him so well—but I refer to Dr. Hugh Bennett, chief of the Soil Conservation Service.

Let me say here that it has been my observation that soil improvement pays almost immediate as well as long-time dividends. I think that we have probably said too much about long-time returns and have not sufficiently emphasized the fact that almost everything you can do in the way of soil improvement this year will pay you good dividends next year as well as in the years to come.

I was discussing the loss of humus from the soil. And I want to refer to something that is very familiar to all of you. When you set fire to a straw pile what happens? Of course, you say, it burns up! But what does that mean? It simply means that the organic material in the straw, principally cellulose, combines with the oxygen of the air, forming carbon dioxide, and a little bit of ash—the mineral content of the straw—is left on the ground. When you burn a stubble field or corn stalks or any other dead plant material, the same things happen.

The decay of organic material—of wood or straw or stalks or leaves—is simply a slow-burning process, the cellulose or carbon-containing material combines slowly with oxygen and forms exactly the same carbon dioxide that would be formed if the material were burned by fire.

This is what has happened, beginning about 50 years ago. Your fathers and grandfathers came here and, in order to raise crops and support their families, they plowed up the prairies and cleared the forest land as rapidly as possible. The soil, which up to that time, had been growing grasses and trees for many thousands of years, was well supplied with humus. And I am not in any sense criticizing the pioneers. They had a job to do and they did it well. Under the conditions that confronted them they could not have done the job much differently.

Cultivation and removal of crops did two things that have profoundly affected your present-day problems. Cultivation hastens the decay and destruction of soil organic matter just like stirring the fire makes it burn faster, and the constant removal of crops has depleted the plant food supply in your soils. The inevitable result was that the soil became poorer and poorer; in fact, it would almost seem that the process of soil impoverishment was speeded up as much as possible by farm practices that encouraged erosion by failure to save and use animal manures and in many cases by burning organic material which might have been returned to the soil.

The very fact that you have organized yourselves into a soil conservation district shows beyond any question that it is entirely unnecessary for me to dwell further on the causes of soil destruction. You are fully aware of what has happened and you are taking constructive and practical steps to remedy the damage.

The Replacement of Humus in the Soil

I shall therefore devote the remainder of my time to an attempt to answer the third question, "*How can we build up the supply of organic matter in our soils and use it to the best advantage?*"

Before discussing specific methods of getting organic matter or humus into the soil I want to discuss very briefly two conditions which confront you and from which there is no escape.

One of the conditions that you cannot change is climate. Here in this district your annual rainfall is about 38 inches on the average. The average date of your last killing frost in the spring is March 28 and of your first killing frost in the fall November 4—a growing season of 221 days. Just for comparison, my home county in Indiana has an average annual rainfall of 38 inches, exactly the same as yours, but our last killing frost in the spring comef on May 1, on the average, and the first killing frost in the fall on October 16—a growing season of 168 days—53 days shorter than yours.

There are some advantages in having a long growing season, but there is at least one disadvantage; that is from the viewpoint of holding humus in the soil. In that connection your long growing season means that the soil bacteria have nearly two months longer to work in Oklahoma than they have in Indiana, and for that reason the problem of holding even a fair supply of humus in your soil is much more difficult than in States farther north, although still not as difficult as in the deep South.

The other condition I wish to mention, from which you cannot escape, is that you must of necessity cultivate your soil, thereby increasing the rate of humus loss if you are to continue farming. But although you can not eliminate this condition, you can and you are changing it very materially.

I shall now discuss some of the methods of getting humus into the soil, and I think it is worth mentioning that this is not as difficult as it might seem. Nature will do most of the job anyway, but there are some things that we must do ourselves.

You may not have thought about it, but the weeds that come up in your corn and cotton fields after you have stopped cultivating, and those that come up in your grain fields after harvest, produce a lot of organic matter and when turned under add humus to the soil. I would not advocate the growing of weeds, but when they do not compete with growing crops for moisture and plant food they may be quite beneficial.

Farm manure is an important source both of organic matter and of plant food. I realize that your livestock is out in the fields most of the year and that the better part of the manure produced on your farms is distributed by the animals. However, that which is produced in barns or feed lots will pay excellent returns for careful handling, and I feel sure it will pay well to supplement your manure with superphosphate. I do not pretend to know a great deal about your local fertility problems, but I do know that most soils, even pretty good soils, begin to show phosphorus deficiency after about 50 years of cultivation, and Oklahoma is probably no exception to the rule.

Use of Crop Residues to Supply Humus

One of the most effective methods of getting organic matter into the soil is to save all of the crop residues. The roots are already in the soil. I refer, therefore, to straw and stubble of grain and hay crops, to the stalks of corn and cotton, and to the leaves and stems of other crops. Of course, if the soil is poor, if it lacks plant food, the crops will be small and the quantity of organic matter in the form of residues will likewise be small. This applies also to the roots. Many experiments that have been conducted throw light on this point. For example, at the West Virginia Experiment Station well-fertilized land produced 59 tons of crops in 15 years, as compared to only 20 tons of crops produced on unfertilized land; and at the end of the experiment the fertilized land contained 30 tons of humus per acre, while the unfertilized land contained only 21 tons. The plant food added in the fertilizer nearly trebled the yield of the corn, grain, and hay crops and the humus content of the soil at the same time.

I fully realize that the plowing under of a lot of straw does not always prove satisfactory. Sometimes it has decreased the yield of the following crop. Realizing this, many farmers have burned their straw instead of returning it to the land. For a long time the poor results obtained from plowing under straw or corn stalks were not understood by scientists. But now we know the reason—it is simply this: The bacteria that break down the organic matter into humus need nitrogen and other plant foods. Straw, corn stalks, and other non-leguminous crop residues are low in nitrogen, high in cellulose, or carbonaceous, material. When this low-nitrogen organic material is plowed under, the bacteria actually use up some of the soil nitrogen and the following crop is starved for nitrogen, especially during the early part of the growing season. This condition can be corrected by an application of commercial nitrogen when the straw is plowed under. It will feed the bacteria, hasten the decay of the organic material, aid in holding a larger amount of the organic matter in the soil as humus, and supply available nitrogen for the next crop. I am not saying that this practice will be possible under your conditions, but commercial nitrogen is much cheaper than it was a few years ago, is likely to cost even less when this war is over, and will be very plentiful.

The alternative to plowing under straw is to practice what we know as "stubble-mulch farming." By leaving the straw on the surface or mixed with only the surface soil it aids in conserving soil moisture, and unless it is too heavy should not cause nitrogen starvation which may result from plowing it under. It will, of course, decay slowly and eventually will add to the humus supply of the soil. I know that your soil scientists in the Soil Conservation Service and at your State Experiment Station are studying stubble-mulch farming thoroughly and can give you sound and practical advice. It is by no means a new practice; we are just learning more about the extent to which it can be used in preventing erosion and in reducing the cost of crop production. For as long as I can remember, the bulk of the oat crops in the Middle West has been seeded in corn stalks with a mere discing of the land to lay the stalks flat on the ground and to chop them up a bit. Now we are de-

(Continued on page 20)

The American Chemical Society

Abstracts of Papers Presented at the Meeting of the Division of Fertilizer Chemistry at Pittsburgh, Pa., September 6 to 10, 1943, H. B. Siems, Presiding

The Chlorophosphate Process for the Production of Dicalcium Phosphate

E. J. Fox and K. G. Clark, Bureau of Plant Industry, Soils and Agricultural Engineering, U. S. Department of Agriculture, B. P. I. Station, Beltsville, Md.

Aqueous or gaseous hydrochloric acid may be used on phosphate rock in conjunction with phosphoric acid and/or sulfuric acid for the production of calcium chloride-free monocalcium chlorophosphate. By ammoniation, the latter may be converted into a mixture of dicalcium orthophosphate and ammonium chloride. Or, by a simple thermal treatment in the presence of water vapor, the hydrochloric acids may be recovered and the residue converted to dicalcium phosphate.

The use of hydrochloric acid on phosphate rock without the addition of phosphoric acid yields an excess of calcium chloride which interferes with the conversion of the monocalcium chlorophosphate to dicalcium phosphate because it preferentially reacts with it to yield chlorospodiosite.

Thermal decomposition of the calcium chloride-free monocalcium chlorophosphate without the addition of water vapor proceeds in two steps, yielding, as the final solid product, unavailable calcium pyrophosphate.

The production of dicalcium phosphate by the chlorophosphate process would permit substantial economies in reagent material over methods currently employed in the production of available phosphates.

Agronomic Value of Alkylation-Acid Superphosphate as Determined by Greenhouse and Laboratory Experiments

Elif V. Miller and K. D. Jacob, Bureau of Plant Industry, Soils, and Agricultural Engineering, U. S. Department of Agriculture

Superphosphates made in the one case with clear sulfuric acid and in the other with spent sulfuric acid from the manufacture of high-octane gasoline by the alkylation process, had practically identical effects on the growth of German millet, Korean lespedeza, and Detroit Dark Red table beets in Evesboro loamy sand and Chester loam soils under greenhouse conditions, even when they were applied at rates as high as 2000 pounds of total P_2O_5 per acre.

At the same rates of application, the superphosphates had similar effects on the pH values of the Evesboro soil under millet in the greenhouse experiments, and on the nitrification of ammonium sulphate in laboratory experiments with the same soil.

Leaf Analysis in Diagnosing the Effect of Potash on Fruit Size and Yield of Cling Peaches in California

P. D. Caldis, A. R. Brown, and R. T. Marks, California Packing Corporation, 101 California Street, San Francisco, Calif.

The yield of cling peaches depends on the ability of the tree to size a crop, regulated by thinning. To determine the causes of partial inability on a 3000-acre ranch near Merced, Calif., leaf analysis was resorted to. Comparative analyses, yearly since 1937, of leaves of peach trees from various blocks of the Merced and neighboring orchards, have revealed the K_2O content of the Merced ranch ranging between 0.87 and 2.73 per cent, while well yielding and sizing orchards in neighboring counties but different soil types, analyzed 2.72 to 5.19 per cent. No symptoms of potash deficiency could be observed and in many respects the trees, fertilized adequately with nitrogen, appear normal. Applications of potash and phosphorus either alone or in combinations, yearly, at 900 pounds per acre each, have not shown response, until single applications of 4000 pounds of potassium sulphate per acre were made. Without further applications, the K_2O content was increased gradually to 2.53 per cent from 0.87 per cent at the end of the fourth year since application; the mean diameter of the fruit was increased by 2 mm., while the yield of No. 1 fruit was increased by 4.8 tons. A potash survey of the ranch was carried out by means of leaf analysis and the deficient areas treated in 1942.

Fertilizers and Fertilizer Chemicals in Wartime

Charles J. Brand, The National Fertilizer Association

Maximum food production is a necessity in the war program. Our armed forces and our civilian population must be adequately fed and large additional quantities of food furnished to our Allies under Lend-Lease and Good Neighbor commitments. Our first job is to make all top-grade soils produce to the

(Continued on page 24)

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A MAGAZINE INTERNATIONAL IN SCOPE AND CIRCULATION DEVOTED EXCLUSIVELY TO THE COMMERCIAL FERTILIZER INDUSTRY AND ITS ALLIED INDUSTRIES

PIONEER JOURNAL OF THE FERTILIZER INDUSTRY

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Principal Articles in This Issue

FERTILIZERS AND FOOD PRODUCTION... 5
ORGANIC MATTER—THE LIFE OF THE SOIL 8
THE AMERICAN CHEMICAL SOCIETY.... 11
New Fertilizer Index Developed..... 12
September Crop Report Indicates Decrease..... 13
Cottonseed Products, August 1, 1942 to July 31, 1943..... 14
FERTILIZER MATERIALS MARKET:
Baltimore..... 15
Charleston..... 15
Chicago..... 17
Philadelphia..... 17
August Tax Tag Sales..... 18

New Fertilizer Index Developed

Another step toward getting the maximum crop increases from fertilizer is made possible through a so-called "salt index" recently devised by Department of Agriculture scientists. This index shows how much a fertilizer may increase the soluble salts in the soil, a condition that when bad enough may cause low germination of seeds and burning of seedlings.

According to scientists of the Department's Agricultural Research Administration, commercial fertilizers are composed partly of materials that in some soils may produce this salt injury, especially where large applications are used in the plant row or in bands near the row. It has been known that such seed or seedling injury could be avoided by a suitable change in the formula of the fertilizer, but until the "salt index" was devised there was no convenient way of measuring the tendency of a fertilizer to introduce too much soluble salt into the soil.

The investigators say salt injury to a crop can be prevented by (1) locating the fertilizer zone farther from the row of plants, (2) by reducing the amount of fertilizer, or (3) by using a fertilizer with a low salt index.

In general, if no plant injury intervenes, fertilizer will be most efficient if it is placed close to the row where weeds will not take so much of it and where the roots of the seedlings will get to it quickly so the plant can make strong early growth. The scientists remind crop producers that reducing the amount of fertilizer to avoid injury might mean employing less plant food than the crop could economically use. Hence they emphasize the importance to farmers of having a fertilizer with a known and low salt index, which can be used in desirable quantity and in the location best for feeding the crop. The fertilizer investigators, L. F. Rader, L. M. White, and C. W. Whittaker, of the Bureau of Plant Industry, Soils and Agricultural Engineering, have learned how to work out quickly the salt index of any fertilizer whose composition is known. Detailed reports published in technical papers show it is now possible with this index figure to predict by a simple calculation the relative tendency of any fertilizer to injure crops. Calculation tables for the use of fertilizer manufacturers and agronomists have been developed by the Department scientists.

The better control of crops resulting from this new method, the discoverers say, should give the farmer larger yields with the expenditure of less fertilizer.

Winter Cover Crops Recommended for Southern States

A Mississippi committee, made up of crops, pasture, and livestock workers, in view of the serious feed shortage, has recommended extensive planting of winter cereals and other cover crops. Fertilizer recommendations for legumes include the use of 300 pounds of 0–14–7, or its equivalent, and for all grains planted with legumes, an additional top-dressing of 150 pounds of nitrate of soda, or its equivalent, in February or the use of 400 pounds 5–10–5 fertilizer plus 500 pounds of limestone before planting instead of the 0–14–7. The AAA has extended its 1943 program year until January 1, and made allowances for seeding up to $5.00 per acre, with no limitations on acreages planted. It is understood that some modification of this plan will be extended at least to Alabama, Arkansas, Georgia, and by next year to nearly all of the States planting cover crops, in so far as funds are available for payment. This should increase fall sales of fertilizer, conserve soil and increase feed from grazing crops.

September Crop Report Indicates Decrease

According to the general crop report of the U. S. Department of Agriculture, indications on September 1 were that total crop production will be 7 per cent less than last year, although 4 per cent higher than in any previous year. The corn crop is now forecast at 2,985,000,000 bushels, 6 per cent less than last year but the second largest crop since 1920. Bumper corn crops are in prospect for most of the Corn Belt, with all-time record production in Iowa, Wisconsin, and Minnesota, and near-record yields in Illinois, Indiana and Ohio. Yields were cut in the South and West by August drought, but the national average may be 31.7 bushels per acre, 6.8 bushels above the 10-year (1932–41) average. There will be record crops of beans, peas, soybeans, peanuts, rice, potatoes, flaxseed, and grapes.

The 1943 indicated production and comparison with 1942, respectively, for important crops are: wheat, 834,957,000 bushels, 15 per cent less; oats, 1,145,060,000 bushels, 16 per cent less; barley, 333,282,000 bushels, 22 per cent less; sorghums for grain, 102,495,000 bushels, 4 per cent less; rice, 71,217,000 bushels, 7 per cent more; sugar beets, 7,546,000 tons, 35 per cent less; sugar cane, 6,586,000 tons, 8 per cent more; tobacco, 1,371,604,000 pounds, 3 per cent less; soybeans, 208,763,000 bushels, slightly less; peanuts, 2,801,515,000 pounds, 27 per cent more; potatoes, 460,512,000 bushels, 24 per cent more; sweet potatoes, 71,623,000 bushels, 12 per cent less; and hay, 96,500,000 tons, 10 per cent less. Pasture conditions and feed supply in most of the Southern States are the poorest since 1936. Production of eight major deciduous fruits will average about 16 per cent less than last year. Combined production of all commercial truck crops for the fresh market may be 9 per cent less while truck crops for processing will be 6 per cent less than 1942. Fall fresh-market crops will be about 3 per cent less than last year.

The cotton crop is now estimated at 11,679,000 bales, a decrease of 7 per cent from the forecast of August 1, and 9 per cent less than the production in 1942. Hot, dry weather during August has severely decreased production in Arkansas, Mississippi, Oklahoma, Texas, and Tennessee. Only Alabama, Florida, Louisiana, New Mexico, and South Carolina are expected to produce more cotton than ginned last year. The average lint yield per acre is now estimated at 258.7 pounds from 21,672,000 acres for harvest.

Sulphate of Ammonia Production During July

There were few changes in the figures of the U. S. Bureau of Mines on the production of by-product sulphate of ammonia and ammonia liquor during July. Shipments of sulphate of ammonia, however, increased about 50 per cent, although stocks on hand at the end of the month showed practically no change. Production for the first seven months of the year is about 2 per cent under the 1942 rate.

	Sulphate of Ammonia	Ammonia Liquor
Production	Tons	Tons NH_3
July, 1943	62,257	2,878
June, 1943	60,144	2,794
July, 1942	64,287	2,790
January–July, 1943	439,683	19,831
January–July, 1942	448,168	19,031
Shipments		
July, 1943	61,725	2,961
June, 1943	40,587	2,804
July, 1942	21,330	2,988
Stocks on hand		
July 31, 1943	40,034	957
June 30, 1943	39,567	922
July 31, 1942	62,654	711
June 30, 1942	19,760	761

Cottonseed Products, August 1, 1942 to July 31, 1943

COTTONSEED RECEIVED, CRUSHED, AND ON HAND (TONS)

State	Received at mills* Aug. 1 to July 31		Crushed Aug. 1 to July 31		On hand at mills July 31	
	1943	1942	1943	1942	1943	1942
United States	4,514,728	3,959,835	4,496,942	4,008,436	89,817	81,928
Alabama	257,846	222,405	259,004	230,245	2,175	3,333
Arizona	82,864	78,234	83,252	78,060	3	391
Arkansas	473,207	476,267	475,928	489,322	9,100	11,875
California	158,430	158,887	152,709	164,207	6,896	1,175
Georgia	343,224	269,435	343,320	284,294	3,961	4,057
Louisiana	166,321	86,111	166,518	85,893	547	744
Mississippi	750,766	569,146	745,605	566,931	11,402	6,241
North Carolina	272,033	215,399	272,667	222,024	1,023	3,111
Oklahoma	219,522	240,151	222,194	236,219	1,792	4,464
South Carolina	207,789	122,232	205,145	124,540	2,591	700
Tennessee	383,041	398,328	388,962	409,809	3,266	9,187
Texas	1,054,627	982,979	1,042,924	974,814	44,658	35,359
All Other States	145,058	140,261	138,714	142,078	2,403	1,291

*Does not include 81,928 and 130,529 tons on hand August 1 nor 63,559 and 68,845 tons reshipped for 1943 and 1942, respectively. Does include 9,897 tons destroyed for 1943.

COTTONSEED PRODUCTS MANUFACTURED, SHIPPED OUT, AND ON HAND

Item	Season	On hand Aug. 1	Produced Aug. 1 to July 31	Shipped out Aug. 1 to July 31	On hand July 31
Crude oil	1942–43	*34,460	1,400,259	1,401,677	*21,825
(thousand pounds)	1941–42	29,708	1,249,872	1,250,671	34,460
Refined oil	1942–43	†310,191	‡1,297,034	.....	†207,081
(thousand pounds)	1941–42	294,005	1,157,917	.....	310,191
Cake and meal	1942–43	190,100	1,994,053	2,165,560	18,593
(tons)	1941–42	164,444	1,752,610	1,726,954	190,100
Hulls	1942–43	44,118	1,084,755	1,116,887	11,986
(tons)	1941–42	151,439	991,521	1,098,842	44,118
Linters	1942–43	43,295	§1,355,221	1,263,400	§135,116
(running bales)	1941–42	123,154	1,183,963	1,263,822	43,295
Hull fiber	1942–43	229	36,417	36,015	631
(500-pound bales)	1941–42	1,834	31,353	32,958	229
Grabbots, motes, etc.	1942–43	23,644	63,615	72,978	14,281
(500-pound bales)	1941–42	6,183	55,300	37,839	23,644

*Includes 24,484,000 and 12,863,000 pounds held by refining and manufacturing establishments and 2,118,000 and 2,522,000 pounds in transit to refiners and consumers August 1, 1942 and July 31, 1943, respectively.

†Includes 3,620,000 and 3,203,000 pounds held by refiners, brokers, agents, and warehousemen at places other than refineries and manufacturing establishments and 1,389,000 and 5,135,000 pounds in transit to manufacturers of shortening, soap, etc., August 1, 1942 and July 31, 1943, respectively. Does not include winterized oil.

‡Produced from 1,393,80[illegible],000 pounds of crude oil.

§Total linters produced includes 29,661 bales first cut, 138,086 bales second cut and 1,187,474 bales mill run. Total held includes 8,289 bales first cut, 13,959 bales second cut and 112,868 bales mill run.

EXPORTS AND IMPORTS OF COTTONSEED PRODUCTS

In the interest of national defense, the Department of Commerce has discontinued until further notice the publication of statistics concerning imports and exports.

BRADLEY & BAKER

FERTILIZER MATERIALS - FEEDSTUFFS

AGENTS - IMPORTERS - BROKERS

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504 Merchants Exchange Bldg., St. Louis, Mo.

FERTILIZER MATERIALS MARKET

BALTIMORE

Only Routine Business Developing. South American Ammoniates Arriving. Shortage of Sulphuric Acid Affects Superphosphate Production.

Exclusive Correspondence to "The American Fertilizer"

BALTIMORE, September 7, 1943.

There have been no outstanding features in the fertilizer business during the past few weeks, and everything has been along more or less routine lines, which is usual at this time of the year.

Ammoniates.—The demand for organic ammoniates for feeding purposes continues unabated with a ready market for all available supplies as they are produced. However, recently fairly large shipments of South American ammoniates have arrived which have helped relieve the situation but have not filled the shortage. The first shipment of 10,000 tons of cottonseed meal, also from South America, has been reported and, should these supplies be augmented in a material way, they are bound to have their effect on the market and assist manufacturers in producing the larger tonnage required by the Government for next year's crops.

Sulphate of Ammonia.—This article is still being distributed on allocation basis in connection with liquid ammonia and ammonium nitrate, and manufacturers are taking deliveries, storing stocks for next season's business. No change in price is expected.

Nitrate of Soda.—It is reported that stocks are in fairly good volume at various seaport warehouses, but the market remains unchanged, and deliveries are still being made against allocations.

Fish Meal.—The entire production of Chesapeake Bay fish scrap is going into fish meal at ceiling price which takes it out of the class of fertilizer material.

Superphosphate.—Stocks of phosphate rock on hand are ample but the Government demand for sulphuric acid is so heavy that some of the producers are unable to produce superphosphate to the extent of their capacity. Therefore, this material may be added to the "hard to get" list by the time next spring arrives. In the meantime the ceiling price is 64 cents per unit of A. P. A. for run-of-pile. The market remains steady with no immediate change anticipated.

Bone Meal.—This situation continues unchanged with offerings at a minimum and prices strictly nominal on the basis of $50 per ton f. o. b. Baltimore for both raw and steamed bone meal.

Bags.—It is still illegal to use new burlap bags for the shipment of fertilizer, but some manufacturers feel that this drastic decision may be modified in the near future. In the meanwhile the market on burlap remains high and unchanged, although shipments are now coming through in somewhat better volume as compared with six months ago.

CHARLESTON

Imports of South American Organic Materials Reported but Allocated to Feed Manufacturers. Superphosphate Production Hampered.

Exclusive Correspondence to "The American Fertilizer"

Nitrogenous.—No further allocations of any nitrogenous material have been made, and the producers of these materials are having labor trouble.

Castor Pomace.—Additional quantities of castor beans have arrived at New York, but so far producers have not caught up with the demand.

Dried Blood.—Recently there have been further importations of South American blood, but this has all gone into feed. Chicago market unchanged, still $5.53 per unit of ammonia ($6.72 per unit N), f. o. b., Chicago.

Cottonseed Meal.—There has been some discussion of the WFA allowing the importation of 40,000 tons of cottonseed meal for fertilizer use, but an announcement by the Government dated September 6th states that a small quantity has already arrived in New York, and the remainder is scheduled for shipment in the next six months. On arrival it will be allocated to feeders throughout the Atlantic states.

Superphosphate.—While all statistics show that supplies of rock can be obtained, an insufficient supply of sulphuric acid still remains the limiting factor in the production of superphosphate.

FERTILIZER MATERIALS

LET US QUOTE YOU ON YOUR REQUIREMENTS OF THESE MATERIALS

✤

PHOSPHATE ROCK

✤

SUPERPHOSPHATE

✤

DOUBLE SUPERPHOSPHATE

✤

NITRATE *of* SODA

✤

SULPHURIC ACID

✤

SULPHATE *of* AMMONIA

✤

BONE MEALS

✤

POTASH SALTS

✤

DRIED BLOOD

✤

TANKAGES

✤

COTTONSEED MEAL

✤

BONE BLACK

✤

PIGMENT BLACK

✤

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Wilmington, N. C.

CHICAGO

Roll-back on Organics Prices Still Awaited. Increased Livestock Slaughter Promises More Feed Materials.

Exclusive Correspondence to "The American Fertilizer"

CHICAGO, September 7, 1943.

No instructions have as yet been received regarding roll-back prices of organics. Sellers' offerings are very meager, owing principally to shortage of labor, while many buyers are anxiously awaiting additional offerings.

The anticipated increase in the slaughter of livestock will naturally produce more tankage and blood for feed, but other feed products are probably subject to further reduction, so that the feed situation will, no doubt, remain acute.

Ceiling prices are well maintained. High grade ground fertilizer tankage, $3.85 to $4.00 ($4.68 to $4.86 per unit N) and 10 cents; standard grades crushed feeding tankage, $5.53 per unit ammonia ($6.72 per unit N); blood, $5.38 ($6.54 per unit N); dry rendered tankage, $1.21 per unit of protein, Chicago basis.

PHILADELPHIA

Some Cottonseed Meal Released for Fertilizer. Imported Organics for Fertilizers Hoped For. Superphosphate Demand Heavy.

Exclusive Correspondence to "The American Fertilizer"

PHILADELPHIA, September 8, 1943.

During the last couple of weeks, the trade has noted with interest that some cottonseed meal may be used for fertilizer purposes; that imports of animal by-products (chiefly for feeding) are continuing; and that the September price of domestic nitrate of soda remains the same as previously.

Ammoniates.—Noting the continued imports of organic ammoniate materials, the fertilizer industry is now beginning to hope that it will not be long before some of the lower grades will be brought in for fertilizer purposes. However, the feed supply is short, and it may be quite some time before sufficient of the feeding grades arrive to satisfy that demand. It appears as though the fertilizer industry will have to wait for that time, owing to the shortage of shipping space, and the desire to bring in the most valuable and high-grade materials which, on a unit basis, occupy less space. Imports of castor beans have maintained a healthy rate, so that a little easier situation is beginning to appear for castor pomace, although all offerings are taken up quickly.

Sulphate of Ammonia.—Is continuing, of course, under allocation, and the market seems to keep an even position.

Nitrate of Soda.—As mentioned above, the September prices have been posted, and they remain the same as for the preceding months.

Superphosphate.—The demand for shipment against contracts has been heavy, and producers have had to keep supplies moving out at a fast pace. Triple grade, of course, remains scarce, owing to the exportations under Lend-Lease.

Bone Meal.—Still in demand, and the supply remains low.

Potash.—Production is being maintained at a high level, and shipments against contracts is about the only activity in the item.

Gothe Promoted by Southern States Phosphate

Southern States Phosphate and Fertilizer Company of Savannah, Ga., have announced the promotion of H. F. Gothe to the position of Vice-President in charge of production. Mr. Gothe has been connected with the company for over thirty years, having held the position of plant superintendent.

Manufacturers' Sales Agents for **DOMESTIC**

Sulphate of Ammonia

Ammonia Liquor :: Anhydrous Ammonia

HYDROCARBON PRODUCTS CO., INC.

500 Fifth Avenue, New York

August Tax Tag Sales

Sales of fertilizer tax tags in August were at a high level. This was due in part to favorable prospects for a large fall tonnage and in part to the purchase of tags for use in 1944. Sales of tags, to a large extent, reflect the anticipation of future needs rather than actual fertilizer sales in August.

Total sales in August in the 17 reporting States represented 266,000 equivalent tons, compared with 212,000 tons in August, 1942 and 180,000 tons in August, 1941. Increases over last year were reported by 11 States in the South and two in the Midwest.

Sales of 5,817,000 tons in the first eight months of this year exceeded the corresponding period of last year by 13 per cent and 1941 by 15 per cent. Larger sales this year than last have been reported by all of the 17 States.

FERTILIZERS AND FOOD PRODUCTION

(Continued from page 7)

other extra elements is wasteful. But such waste must be balanced against the waste of labor in trying to grow good crops on other soils in which a deficiency of one or more of these essential elements may be the factor that is limiting yields.

A great deal of effort is being expended in determining the mineral-manure needs of each great soil group, and of each soil series and type. When this knowledge has been obtained, consideration must then be given to fitting these findings to the several systems of soil management, and to making such supplemental adjustments as are necessary to meet the specific requirements of the species and variety of crop to be grown. Meanwhile

FERTILIZER TAX TAG SALES

State	August				January–August		
	1943	1942	1941	%	1943	1942	1941
	Tons	Tons	Tons	1942	Tons	Tons	Tons
Virginia	22,783	17,350	11,832	104	352,882	340,218	318,078
North Carolina	4,200	10,304	3,850	105	1,094,485	1,046,587	995,651
South Carolina	4,320	4,010	5,340	115	700,768	611,294	672,547
Georgia	4,754	3,570	2,242	120	876,829	731,950	746,121
Florida	30,507	14,280	34,998	119	489,971	411,258	400,851
Alabama	3,500	1,300	300	112	623,050	555,750	563,200
Mississippi	44,050	6,000	5,550	132	379,044	287,067	321,942
Tennessee	8,439	6,225	4,725	128	192,653	150,180	126,975
Arkansas	16,000	1,350	250	121	156,975	129,308	112,750
Louisiana	750	400	1,500	107	145,188	135,436	148,910
Texas	892	815	655	119	131,127	110,118	118,131
Oklahoma	2,000	450	420	220	17,088	7,761	9,800
Total South	142,195	66,054	71,662	114	5,160,060	4,516,927	4,534,956
Indiana	76,290	102,212	56,072	102	357,530	350,933	299,598
Illinois	8,143	9,393	5,445	107	76,744	71,778	52,446
Kentucky	11,501	7,735	6,566	107	135,501	126,827	104,877
Missouri	24,444	25,389	32,429	121	75,260	62,249	70,500
Kansas	3,563	1,455	8,263	153	11,904	7,760	13,861
Total Midwest	123,941	146,184	108,775	106	656,939	619,547	541,282
Grand Total	266,136	212,238	180,437	113	5,816,999	5,136,474	5,076,238

PULVERIZED
MASCOT
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MAGNESIUM LIMESTONE
"It's a Dolomite"
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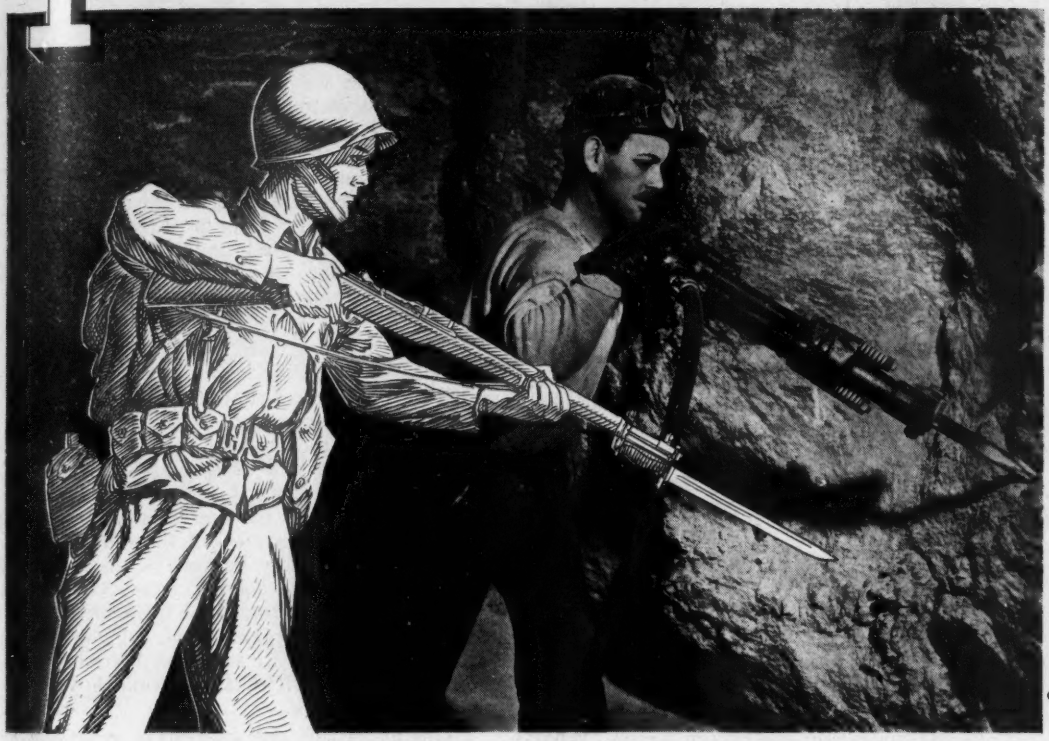
FIGHTING THE AXIS...1000 FEET UNDERGROUND!



DAY and night a deadly campaign is waged against the Axis. The fighters have no armour . . . their guns are aimed at solid rock . . . their uniforms are overalls . . . and their battle takes place far beneath the ground They are mining potash, and it's one of the most vital production stories of this war!

During the first World War, our victory was threatened when the Germans cut off our potash supply. Since that time potash has been discovered beneath the sun-baked deserts of New Mexico in a quantity great enough to supply us for many years to come.

Potash goes into your fertilizers as an important plant nutrient on which the nation's farmers depend for bumper crops of victory food. Potash is also an essential element in the manufacture of drugs, soap, glass, matches, black powder, high-octane aviation gasoline and military fireworks.

Thus does Sunshine State Higrade Muriate of Potash play an integral part in America's great war effort.

SUNSHINE STATE POTASH PRODUCT OF NEW MEXICO U.S.A.

HIGRADE MURIATE OF POTASH 62/63% K_2O
GRANULAR MURIATE OF POTASH 48/52% K_2O
MANURE SALTS 22/26% K_2O

UNITED STATES POTASH COMPANY

TRADE-MARK REG. U. S. PAT. OFF.

so many practical difficulties accrue to the manufacturer of fertilizers that he is compelled to compromise, supplying more of one or another of the three standard elements than may be needed in some cases, and less in another. It now seems that it may be necessary for him to extend this system to boron and magnesium, and possibly to calcium and certain other elements, as well. Fertilizer practice, therefore, may call for some compromise with the ideal. But such compromising can be done without sacrificing the firm scientific foundation on which it is built.

Increasing Dependence Being Placed on Mineral Manures

Only when war has placed its deadly grip on a country does the public come to realize the importance of a plentiful supply of food, and of the agents involved in its production. Among these agents, the mineral manures play a leading part. Given adequate supplies of lime and fertilizer, there is no question about the capacity of this vast land of ours to produce a great deal more food than is required for home consumption. But as we send more and more shiploads of foodstuffs abroad to support our armies and to feed the delivered peoples, certain strains and stresses develop at home. Those of us whose obligation it is to watch over the soil must ever be on the alert against loss of its productive power. The close connection between fertilizers and foodstuffs is apparent. If deficiencies of any of the nutrient elements are allowed to develop, the failure is ours. Whatever the vagaries of the weather, the depredation of insects and disease organisms, or the weaknesses of mankind may be, an adequate supply of food must be forthcoming. Only as this can be guaranteed have the specialists in soils, crops, and fertilizers lived up to their responsibility.

ORGANIC MATTER—THE LIFE OF THE SOIL

(Continued from page 10)

veloping a whole set of new tools and practices which may very likely revolutionize farming, especially in the Great Plains.

Cover Crops Supply Humus

One of your problems with respect to getting humus in your soil is that you grow a large acreage of cultivated crops as compared to the acreage in small grains and in hay crops. You have a lot of land lying bare all through the fall, winter, and early spring. Anything that you can grow that will cover up the nakedness of this land will aid greatly in preventing erosion and, when plowed under, add organic matter to the soil.

I am a great believer in growing legumes for soil improvement, but here again I must leave to your own technicians the job of advising you as to which of the legume crops are best suited to the various situations on your farms. It was my privilege last October to spend three days in studying the results that are being obtained in Soil Conservation Districts in South Carolina and Georgia, and I was greatly impressed by the fine progress that is being made by the farmers of those districts. And it was principally because of my desire to see how you are solving your problems that I accepted an invitation to appear on this program. In parenthesis, let me say frankly that I felt quite sure that I would get more out of the visit that you could hope to get out of this talk.

I will make this one suggestion as to the growing of legumes for soil improvement, namely, that unless they follow a well-fertilized crop, satisfactory results cannot be expected without the use of some fertilizers and the liming of soils that are too acid. It is an almost universal recommendation in the South and I feel perfectly safe in suggesting it.

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Bookkeeper: **"Then I had better put my figures together and see what can be done about covering our requirements for Pulverized 'Aero' Cyanamid at once."**

AMERICAN CYANAMID COMPANY

FERTILIZER DIVISION

30 Rockefeller Plaza **New York 20, N. Y.**

I would prefer, however, that your own agronomists handle the recommendations as to the kind of fertilizer and the rate of application.

Agronomists and farmers agree that it is impractical to grow winter legumes on all of the acres intended for corn or cotton. In fact, it appears to be the general view that winter legumes can be grown only on one-fourth to one-third of the cotton and corn acres each year. This is, of course, due to the fact that in order to get the benefits from the winter legume it is necessary to let it grow rather late in the spring before turning under. However, according to any figures that I am able to obtain, you still have a long way to go here in Oklahoma before you will have a quarter of your cotton and corn acreage growing winter legumes.

A few minutes ago I stated that anything you can grow that will keep the land covered during the fall, winter, and early spring is desirable, and here I want to mention the non-legumes, principally the small grains or mixtures of small grains and legumes. The small grains provide a pretty good soil cover. They can be produced from home-grown seed, they provide excellent pasture and finally green manure. They do not add nitrogen to the soil, but they take up available nitrogen in their tissues and thus prevent its loss through leaching, and they do add fresh organic matter.

Before closing I must mention the value of pastures in maintaining the humus supply of the soil; in fact, I could have used all of the time available in a discussion of grassland farming. If we could just put all the land down to grass, most of our erosion problems would be solved. Unfortunately one of the conditions which I have mentioned from which you cannot escape is that in order to make a living you must cultivate at least a part of your land. I do not know what changes you have made in this District as the result of your farm planning, but in the southeastern States, on the farms that are under agreement, average changes have taken place as follows: The pasture area has been increased by 10 acres, the hay area by 8 acres, and an average of 10 acres of idle or waste land per farm has been put to productive use. The acreages of cotton and corn have been reduced somewhat, but the yields per acre have increased and total production of these crops is now greater than before the changes were made.

We must realize, of course, that plant food, especially phosphorus, and lime are removed by animals grazing on pastures, just as they are removed by crops, and that unless these

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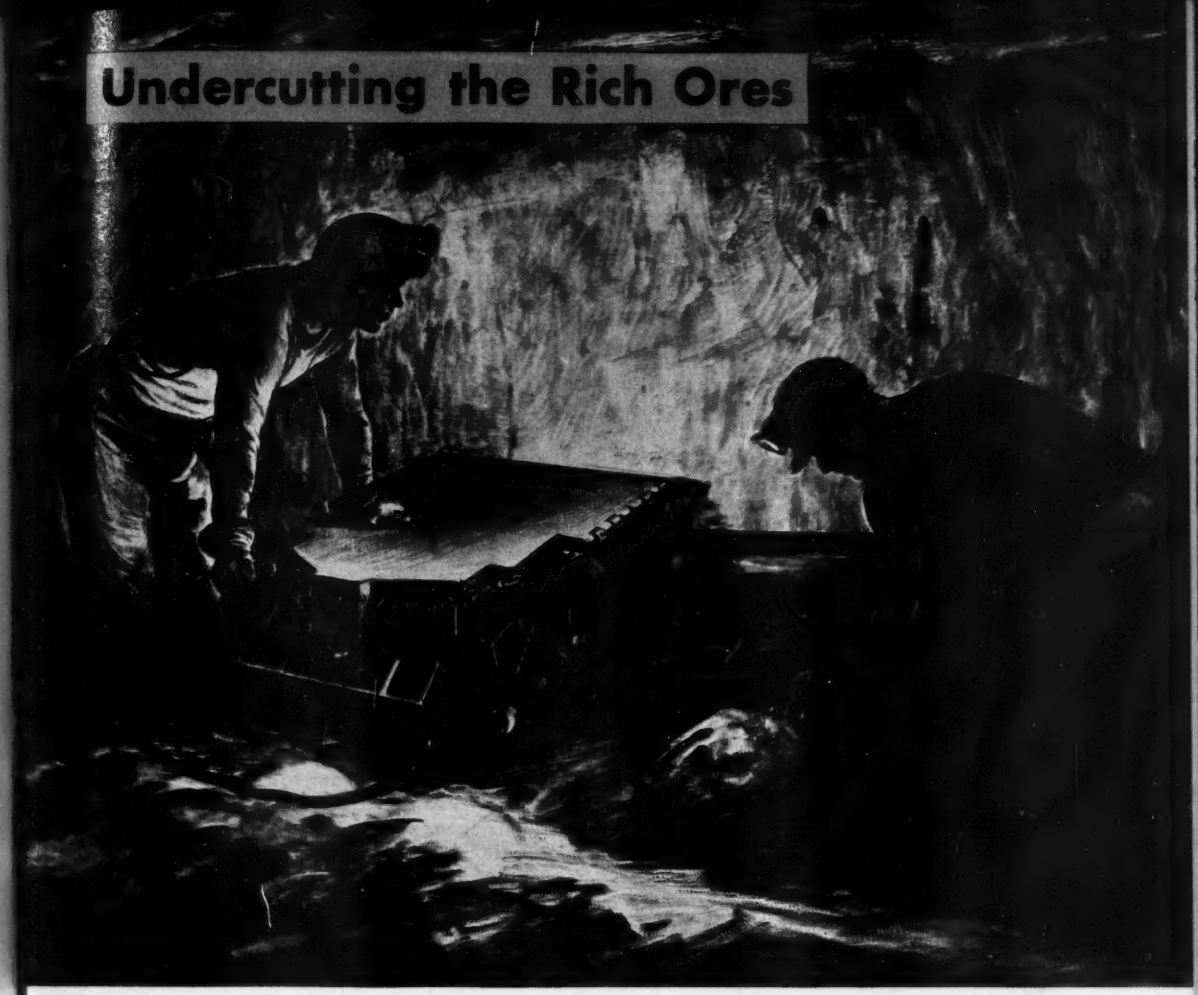
MENTION "THE AMERICAN FERTILIZER" WHEN WRITING TO ADVERTISERS



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Fast, efficient mining methods are only the first step in the preparation of these rich potash salts for the fertilizers which are playing an increasingly important part in the nation's crop production. Exclusive refining processes were developed by International's research chemists and engineers to achieve the high quality and superior mechanical condition which are recognized characteristics of International Potash. The nation is fortunate that domestic potash production is now supplying domestic needs. With both langbeinite and sylvite ores in its New Mexico mine, International is able to offer you a complete line of all grades of potash to meet the requirements of the farmers you serve.

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plant foods are returned to the land, our pastures will decline in fertility and in production. And I should probably add that in many cases the pasture field is the one that was cropped for many years and was already pretty badly run down when it became a pasture. Here again I admit that I am not sufficiently familiar with your conditions to make a recommendation, but I would think that much of your land is acid enough to need liming and is pretty low in available phosphorus.

Summary

I have tried to answer some questions concerning humus in the soil, and I shall now try to summarize those answers briefly.

We want humus in the soil to increase its water-holding capacity, to prevent excessive run-off and erosion, to make it easier to cultivate. Humus also provides energy-producing food for bacteria and other soil organisms; it keeps some of the plant food available and it supplies practically all of the soil nitrogen, much of the available phosphorus, a part of the potash and other plant foods. Without humus the soil would be dead—with it the soil lives and supports life.

The loss of humus which had accumulated in the soils through thousands of years was, to a large extent, the inevitable result of plowing-up the prairies, clearing away the forests, and subsequent cultivation of the land. Much of this loss could not be avoided, and neither can we hope to bring back the original humus content of the land, but we can certainly change our practices now so as to keep what we have, build it back to a level that will make profitable farming possible, and use it to the best advantage in preventing future erosion and in healing the scars that have been made by erosion in the past.

We can build up the humus content of our soils by utilizing to the fullest extent possible the waste and by-products of the farm, by saving and using animal manures, by turning under or surface mulching all crop residues. We can add humus to the soil by growing legumes which at the same time add nitrogen, and we can grow non-legumes which protect the land and provide pastures for our livestock. And we can use lime and fertilizers to increase the growth of all these crops. We can also put some land down to pasture and improve the pastures that we have.

Entirely aside from the economic benefits that will be obtained, there will be other benefits—perhaps more lasting. The very appearance of your country will change when erosion is controlled. Gullies which were getting deeper each year will gradually fill up; eroded hillsides and bare roadbanks will be covered with green foliage. You will not only make a better living but you will make a better place in which to live.

THE AMERICAN CHEMICAL SOCIETY

(Continued from page 11)

maximum before marginal or submarginal soils are brought again under the plow. "Dust bowls" must not again be created. Approximately 20 per cent of the crops grown in the United States are due to increases in yield produced by the use of commercial fertilizer. At present prices paid for fertilizers and received by farmers for crops produced for each dollar spent for fertilizers, a return of five to six dollars is received in increased crop values. Total consumption of fertilizers increased from 7,571,000 tons in 1938 to slightly over 10,000,000 tons in 1942. In the same period governmental distribution by TVA and AAA increased from 81,000 tons to 1,227,000 tons. Many raw materials customarily used for fertilizer manufacture have other war demands. Inorganic nitrogen compounds are the basis for all explosives and many organic nitrogen carriers are in great demand and have been commandeered for animal feeds. Phosphorous compounds are essential in certain incendiaries and in smoke screens. Potash is required for many chemical necessities. The nitrogen shortage of the past two years may be overcome by the release of some ammonia solutions from munitions plants and by the production of ammonium nitrate, somewhat new and untried as a fertilizer material.

In 1942 not over 440,000 tons of N were used in fertilizer. At present it looks as if

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In the fertilizers you make, nitrogen is a life-giving food. That's why in years of peace you used Du Pont "Uramon" fertilizer compound and Du Pont Urea-Ammonia liquors, developed after long years of research. Both are important sources of nitrogen and have proved their ability to grow quality crops.

But nitrogen is also the basic ingredient for military explosives. That's why in wartime, the bulk of Du Pont nitrogen travels another path — to the "plant" which produces "war crops" of another kind.

We can't at the present time do without both kinds of "food." Guns for Victory clamor for it, as well as the farm soil from Maine to Alabama. Du Pont is doing everything possible to help fill the nitrogen requirements on both fronts. E. I. du Pont de Nemours & Co. (Inc.), Ammonia Department, Wilmington, Delaware.

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Fertilizer Compound

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Liquors

BETTER THINGS for BETTER LIVING...THROUGH CHEMISTRY

520,000 to 570,000 tons of N would be available for the fiscal year ending June 30, 1944, plus such nitrate of soda as may be imported from Chile. Production of normal superphosphate is expected to equal 6,500,000 tons in 1943 as compared to a little over 5,000,000 tons in 1942. Sulfur, sulfuric acid, and phosphate rock necessary for this increased production seem assured. Production of potash in this country is expected to reach 700,000 tons of K_2O, but chemical requirements and Lend-Lease commitments will curtail the amount allocated for agriculture to 540,000 tons, about 80 per cent of last year's use.

The fertilizer industry operates now under various orders issued by WPB, OPA, ODT, FWA, MPC, and other war agencies. In the face of many restrictions, of materials scarcity, of labor shortage and of transportation troubles, the industry produced and distributed this year the greatest output in history. Eleven million tons are expected to be furnished for the fiscal year ending June 30, 1944.

Potash in War Production

J. W. Turrentine, The American Potash Institute, Washington, D. C.

The essentiality of potash in American chemical and agricultural industries is a matter of general acceptance, but it takes an all-out war effort and a supply situation demanding the most efficient use possible to make one realize just how essential it is to our war programs. In anticipation of war demands, production has been increased to 700,000 tons K_2O per annum, the largest tonnage ever used in our industries. Chemical industries early were given priority to their demand for the highly refined chemical grades, for it was immediately recognized that in a war of the present chemical era, chemistry was destined to play a role of primary importance. This has amounted to some 10 per cent of total production, a modest demand in view of the variety of uses to which it is put and the vital importance of the products derived. Most of these uses and products have been expanded and others have been added as the result of war-induced new technologies. This requirement now approximates 80,000 tons K_2O, an increase from the prewar use of 39,000 tons.

The remaining 90 per cent was designed for the use of North American agriculture and the fertilizer industry serving agriculture, an amount that would have proved adequate according to estimates of only a few months ago, had it been assigned in its entirety to that use. Any deficit in supply, however small, assumes magnitude reflected by the enormity of the nation's agricultural program—constantly being expanded and repeatedly described as second to none in its importance to our war effort, both as an individual nation and as a member of the United Nations. The production of food, fiber, and vegetable oils in the amounts demanded of us, calls for the application of the best we have in the way of agricultural science, particularly crop nutrition which has been amply demonstrated as the surest, quickest, and cheapest method of increasing crop production. An analysis of the experimental and demonstrational data provided by our unequalled agricultural agencies clearly shows the increased yields obtainable per pound of the individual nutrients when used in proper ratio or balance with each other and relation to crop requirements and soil deficiencies, increases for the country as a whole that run into astronomical figures, unfortunately, however, calling for supplies of nitrogen, phosphate, and potash beyond our capacity to produce. It is this inadequacy in a war emergency that demands the most effective use of what we have.

Experimental data provide an accurate measure of the food, fiber, and oil, equivalent of potash where used on our soils in the ways we have found best, as likewise what we stand to lose from our failure to use it. Also we are told on the highest authority what the proper ratios are and thus can appraise the over-all loss in efficiency when that balance is upset through our failure to include crop nutrients in the ratios prescribed by the agricultural authorities on the basis of their detailed scientific research.

(To be continued)

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Agricultural authorities have shown that a lack of Boron in the soil can result in deficiency diseases which seriously impair the yield and quality of crops.

When Boron deficiencies are found, follow the recommendations of local County Agents or State Experiment Stations.

Information and references available on request.

AMERICAN POTASH & CHEMICAL CORPORATION
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Pioneer Producers of Muriate of Potash in America
See Page 4

BUYERS' GUIDE • A CLASSIFIED INDEX TO ALL THE ADVERTISERS IN "THE AMERICAN FERTILIZER"

This list contains representative concerns in the Commercial Fertilizer Industry, Including fertilizer manufacturers, machinery and equipment manufacturers, dealers in and manufacturers of commercial fertilizer materials and supplies, brokers, chemists, etc.
For Alphabetical List of Advertisers, see page 33.

ACID BRICK
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.

ACID EGGS
Chemical Construction Corp., New York City.

ACIDULATING UNITS
Chemical Construction Corp., New York City.
Sackett & Sons Co., The A. J., Baltimore, Md.

AMMO-PHOS
American Cyanamid Co., New York City.

AMMONIA—Anhydrous
Barrett Division, The, Allied Chemical & Dye Corp., New York City.
DuPont de Nemours & Co., E. I., Wilmington, Del.
Hydrocarbon Products Co., New York City.

AMMONIA LIQUOR
Barrett Division, The, Allied Chemical & Dye Corp., New York City.
DuPont de Nemours & Co., E. I., Wilmington, Del.
Hydrocarbon Products Co., New York City.

AMMONIA OXIDATION UNITS
Chemical Construction Corp., New York City.

AMMONIATING EQUIPMENT
Sackett & Sons Co., The A. J., Baltimore, Md.

AMMONIUM NITRATE SOLUTIONS
Barrett Division, The, Allied Chemical & Dye Corp., New York City.

AUTOMATIC ELEVATOR TAKEUPS
Sackett & Sons Co., The A. J., Baltimore, Md.

BABBITT
Sackett & Sons Co., The A. J., Baltimore, Md.

BAGS AND BAGGING—Manufacturers
Bagpak, Inc., New York City.
Bemis Bro. Bag Co., St. Louis, Mo.
St. Regis Paper Co., New York City.
Textile Bag Mfrs. Association, Chicago, Ill.
Union Bag & Paper Corporation, New York City.

BAGS—Cotton
Bemis Bro. Bag Co., St. Louis, Mo.
Textile Bag Mfrs. Association, Chicago, Ill.

BAGS—Paper
Bagpak, Inc., New York City
Bemis Bro. Bag Co., St. Louis, Mo.
St. Regis Paper Co., New York City.
Union Bag & Paper Corporation, New York City.

BAGS (Waterproof)—Manufacturers
Bemis Bro. Bag Co., St. Louis, Mo.
St. Regis Paper Co., New York City.
Textile Bag Mfrs. Association, Chicago, Ill.
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BAGS—Dealers and Brokers
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Baker & Bro., H. J., New York City.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Wellmann, William E., Baltimore, Md.

BAG CLOSING MACHINES
Bagpak Inc., New York City.

BAGGING MACHINES—For Filling Sacks
Atlanta Utility Works, East Point, Ga.
Bagpak, Inc., New York City.
Sackett & Sons Co., The A. J., Baltimore, Md.

BAG PILERS
Link-Belt Company, Philadelphia, Chicago.

BEARINGS
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

BELT LACING
Sackett & Sons Co., The A. J., Baltimore, Md.

BELTING—Chain
Atlanta Utility Works, East Point, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

BELTING—Leather, Rubber, Canvas
Sackett & Sons Co., The A. J., Baltimore, Md.

BOILERS—Steam
Atlanta Utility Works, East Point, Ga.

BONE BLACK
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Huber & Company, New York City.

BONE PRODUCTS
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

BORAX AND BORIC ACID
American Potash and Chem. Corp., New York City.
Pacific Coast Borax Co., New York City.

BROKERS
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Dickerson Co., The, Philadelphia, Pa.
Huber & Company, New York City.
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Keim, Samuel L., Philadelphia, Pa.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

BUCKETS—Elevator
Link-Belt Company, Philadelphia, Chicago
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

A Classified Index to Advertisers in "The American Fertilizer"

BUYERS' GUIDE

For an Alphabetical List of all the Advertisers, see page 33

BUCKETS—For Hoists, Cranes, etc., Clam Shell, Orange Peel, Drag Line, Special; Electrically Operated and Multi Power
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.

BURNERS—Sulphur
Chemical Construction Corp., New York City.

BURNERS—Oil
Monarch Mfg. Works, Inc., Philadelphia, Pa.
Sackett & Sons Co., The A. J., Baltimore, Md.

CABLEWAYS
Hayward Company, The, New York City.

CARBONATE OF AMMONIA
American Agricultural Chemical Co., New York City.
DuPont de Nemours & Co., E. I., Wilmington, Del.

CARS—For Moving Materials
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CARTS—Fertilizer, Standard and Roller Bearing
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

CASTINGS—Acid Resisting
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Duriron Co., Inc., The, Dayton, Ohio.

CASTINGS—Iron and Steel
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CEMENT—Acid-Proof
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.

CHAIN DRIVES—Silent
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CHAINS AND SPROCKETS
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CHAMBERS—Acid
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.

CHEMICAL APPARATUS
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Duriron Co., Inc., The, Dayton, Ohio.
Monarch Mfg. Works, Inc., Philadelphia, Pa.

CHEMICALS
American Agricultural Chemical Co., New York City.
American Cyanamid Co., New York City.
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Barrett Division, The, Allied Chemical & Dye Corp., New York City.
Bradley & Baker, New York City.
DuPont de Nemours & Co., E. I., Wilmington, Del.
Huber & Company, New York City.

CHEMICALS—Continued
International Minerals & Chemical Corporation, Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Phosphate Mining Co., The, New York City.
Wellmann, William E., Baltimore, Md.

CHEMICAL PLANT CONSTRUCTION
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Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.
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CHEMISTS AND ASSAYERS
Gascoyne & Co., Baltimore, Md.
Shuey & Company, Inc., Savannah, Ga.
Stillwell & Gladding, New York City.
Wiley & Company, Baltimore, Md.

CLUTCHES
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CONCENTRATORS—Sulphuric Acid
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.

CONDITIONERS AND FILLERS
American Limestone Co., Knoxville, Tenn.
Dickerson Co., The, Philadelphia, Pa.
Phosphate Mining Co., The, New York City.

CONTACT ACID PLANTS
Chemical Construction Corp., New York City

COPPER SULPHATE
Tennessee Corporation, Atlanta, Ga.

COTTONSEED PRODUCTS
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Bradley & Baker, New York City.
Huber & Company, New York City
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

CRANES AND DERRICKS
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

CYANAMID
American Agricultural Chemical Co., New York City
American Cyanamid Co., New York City.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Jett, Joseph C., Norfolk, Va.
Wellmann, William E., Baltimore, Md.

DENS—Superphosphate
Chemical Construction Corp., New York City.
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BUYERS' GUIDE

For an Alphabetical List of all the Advertisers, see page 33

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Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

DRYERS—Direct Heat
Sackett & Sons Co., The A. J., Baltimore, Md.

DRIVES—Electric
Link-Belt Company, Philadelphia, Chicago.

DUMP CARS
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

DUST COLLECTING SYSTEMS
Sackett & Sons Co., The A. J., Baltimore, Md.

ELECTRIC MOTORS AND APPLIANCES
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

ELEVATORS
Atlanta Utility Works, East Point, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

ELEVATORS AND CONVEYORS—Portable
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

ENGINEERS—Chemical and Industrial
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

ENGINES—Steam
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

EXCAVATORS AND DREDGES—Drag Line and Cableway
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.
Link Belt Speeder Corp., Chicago, Ill., and Cedar Rapids, Iowa.

FERTILIZER MANUFACTURERS
American Agricultural Chemical Co., New York City.
American Cyanamid Company, New York City.
Armour Fertilizer Works, Atlanta, Ga.
Farmers Fertilizer Company, Columbus, Ohio.
International Minerals and Chemical Corporation, Chicago, Ill.
Phosphate Mining Co., The, New York City.
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.

FISH SCRAP AND OIL
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Wellmann, William E., Baltimore, Md.

FOUNDERS AND MACHINISTS
Atlanta Utility Works, East Point, Ga.
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

GARBAGE TANKAGE
Wellmann, William E., Baltimore, Md.

GEARS—Machine Moulded and Cut
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

GEARS—Silent
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

GELATINE AND GLUE
American Agricultural Chemical Co., New York City.

GUANO
Baker & Bro., H. J., New York City.

HOISTS—Electric, Floor and Cage Operated, Portable
Hayward Company, The, New York City.

HOPPERS
Atlanta Utility Works, East Point, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

IMPORTERS, EXPORTERS
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Wellmann, William E., Baltimore, Md.

IRON SULPHATE
Tennessee Corporation, Atlanta, Ga.

INSECTICIDES
American Agricultural Chemical Co., New York City.

LACING—Belt
Sackett & Sons Co., The A. J., Baltimore, Md.

LIMESTONE
American Agricultural Chemical Co., New York City.
American Limestone Co., Knoxville, Tenn.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
McIver & Son, Alex. M., Charleston, S. C.
Wellmann, William E., Baltimore, Md.

LOADERS—Car and Wagon, for Fertilizers
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

MACHINERY—Acid Making
Atlanta Utility Works, East Point, Ga.
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.
Duriron Co., Inc., The, Dayton, Ohio.
Fairlie, Andrew M., Atlanta, Ga.
Monarch Mfg. Works, Inc., Philadelphia, Pa.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MACHINERY—Coal and Ash Handling
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

MACHINERY—Elevating and Conveying
Atlanta Utility Works, East Point, Ga.
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MACHINERY—Grinding and Pulverizing
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind

A Classified Index to Advertisers in "The American Fertilizer"

BUYERS' GUIDE

For an Alphabetical List of all the Advertisers, see page 13

MACHINERY—Power Transmission
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MACHINERY—Pumping
Atlanta Utility Works, East Point, Ga.
Duriron Co., Inc., The, Dayton, Ohio.

MACHINERY—Tankage and Fish Scrap
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MAGNETS
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MANGANESE SULPHATE
McIver & Son, Alex. M., Charleston, S. C.
Tennessee Corporation, Atlanta, Ga.

MIXERS
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

NITRATE OF SODA
American Agricultural Chemical Co., New York City.
Armour Fertiliser Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Barrett Division, The, Allied Chemical & Dye Corp., New York City.
Bradley & Baker, New York City.
Chilean Nitrate Sales Corp., New York City.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

NITRATE OVENS AND APPARATUS
Chemical Construction Corp., New York City.

NITROGEN SOLUTIONS
Barrett Division, The, Allied Chemical & Dye Corp., New York City.

NITROGENOUS ORGANIC MATERIAL
American Agricultural Chemical Co., New York City.
Armour Fertiliser Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
DuPont de Nemours & Co., Wilmington, Del.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Smith-Rowland Co., Norfolk, Va.
Wellmann, William E., Baltimore, Md.

NOZZLES—Spray
Monarch Mfg. Works, Philadelphia, Pa.

PACKING—For Acid Towers
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.

PANS AND POTS
Stedman's Foundry and Mach. Works, Aurora, Ind.

PHOSPHATE MINING PLANTS
Chemical Construction Corp., New York City.

PHOSPHATE ROCK
American Agricultural Chemical Co., New York City.
American Cyanamid Co., New York City.
Armour Fertiliser Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Coronet Phosphate Co., New York City.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Phosphate Mining Co., The, New York City.
Ruhm, H. D., Mount Pleasant, Tenn.
Schmaltz, Jos. H., Chicago, Ill.
Southern Phosphate Corp., Baltimore, Md.
Virginia-Carolina Chemical Corp. (Mining Dept.), Richmond, Va.
Wellmann, William E., Baltimore, Md.

PIPE—Acid Resisting
Duriron Co., Inc., The, Dayton, Ohio.

PIPES—Chemical Stoneware
Chemical Construction Corp., New York City.

PIPES—Wooden
Stedman's Foundry and Mach. Works, Aurora, Ind.

PLANT CONSTRUCTION—Fertilizer and Acid
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

POTASH SALTS—Dealers and Brokers
American Agricultural Chemical Co., New York City.
Armour Fertiliser Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
Jett, Joseph C., Norfolk, Va.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

POTASH SALTS—Manufacturers
American Potash and Chem. Corp., New York City.
Potash Co. of America, New York City.
International Minerals & Chemical Corp., Chicago, Ill.
United States Potash Co., New York City.

PULLEYS AND HANGERS
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

PUMPS—Acid-Resisting
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Duriron Co., Inc., The, Dayton, Ohio.
Monarch Mfg. Works, Inc., Philadelphia, Pa.

PYRITES—Brokers
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., New York City.
Wellmann, William E., Baltimore, Md.

QUARTZ
Charlotte Chem. Laboratories, Inc., Charlotte, N. C

RINGS—Sulphuric Acid Tower
Chemical Construction Corp., New York City.

ROUGH AMMONIATES
Bradley & Baker, New York City.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

A Classified Index to Advertisers in "The American Fertilizer"

BUYERS' GUIDE

For an Alphabetical List of all the Advertisers, see page 33

SCALES—Including Automatic Bagging
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

SCRAPERS—Drag
Hayward Company, The, New York City.

SCREENS
Atlanta Utility Works, East Point, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

SEPARATORS—Air
Sackett & Sons Co., The A. J., Baltimore, Md.

SEPARATORS—Including Vibrating
Sackett & Sons Co., The A. J., Baltimore, Md.

SEPARATORS—Magnetic
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

SHAFTING
Atlanta Utility Works, East Point, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

SHOVELS—Power
Link-Belt Company, Philadelphia, Chicago.
Link-Belt Speeder Corporation, Chicago, Ill., and Cedar Rapids, Iowa.
Sackett & Sons Co., The A. J., Baltimore, Md.

SPRAYS—Acid Chambers
Monarch Mfg. Works, Inc., Philadelphia, Pa.

SPROCKET WHEELS (See Chains and Sprockets)

STACKS
Sackett & Sons Co., The A. J., Baltimore, Md.

SULPHATE OF AMMONIA
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Barrett Division, The, Allied Chemical & Dye Corp., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
Hydrocarbon Products Co., New York City.
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

SULPHUR
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Freeport Sulphur Co., New York City.
Texas Gulf Sulphur Co., New York City.

SULPHURIC ACID
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M. Charleston, S. C.

SULPHURIC ACID—Continued
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.
Wellmann, William E., Baltimore, Md.

SUPERPHOSPHATE
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.
Wellmann, William E., Baltimore, Md.

SUPERPHOSPHATE—Concentrated
Armour Fertilizer Works, Atlanta, Ga.
International Minerals & Chemical Corporation, Chicago, Ill
Phosphate Mining Co., The, New York City.
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.

SYPHONS—For Acid
Monarch Mfg. Works, Inc., Philadelphia, Pa.

TALLOW AND GREASE
American Agricultural Chemical Co., New York City.

TANKAGE
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
Smith-Rowland, Norfolk, Va.
Wellmann, William E., Baltimore, Md.

TANKAGE—Garbage
Huber & Company, New York City.

TANKS
Sackett & Sons, Co., The A. J., Baltimore, Md.

TILE—Acid-Proof
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.

TOWERS—Acid and Absorption
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.

UNLOADERS—Car and Boat
Hayward Company, The, New York City.
Sackett & Sons Co., The A. J., Baltimore, Md.

UREA
DuPont de Nemours & Co., E. I., Wilmington, Del.

UREA-AMMONIA LIQUOR
DuPont de Nemours & Co., E. I., Wilmington, Del.

VALVES—Acid-Resisting
Atlanta Utility Works, East Point, Ga.
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Duriron Co., Inc., The, Dayton, Ohio.
Monarch Mfg. Works, Inc., Philadelphia, Pa.

WHEELBARROW (See Carts)

ZINC SULPHATE
Tennessee Corporation, Atlanta, Ga.

ALPHABETICAL LIST OF ADVERTISERS

For Classified Index, see pages 28 to 32, inclusive

American Agricultural Chemical Co., New York City....2nd Cover
American Cyanamid Co., New York City.21
American Limestone Co., Knoxville, Tenn..18
American Potash and Chemical Corp., New York City....4, 27
Armour Fertilizer Works, Atlanta, Ga.....16
Ashcraft-Wilkinson Co., Atlanta, Ga. Front Cover
Atlanta Utility Works, East Point, Ga....—

Baker & Bro., H. J., New York City.....—
Barrett Division, Allied Chemical & Dye Corporation, New York City.....—
Bemis Bro. Bag Co., St. Louis, Mo..... 3
Bradley & Baker, New York City.....14

Charlotte Chemical Lab., Charlotte, N. C.—
Chemical Construction Corp., New York City.....—
Chilean Nitrate Educational Bureau, New York City.....34

Dickerson Co., The, Philadelphia, Pa.....—
Dougherty, Jr., E., Philadelphia, Pa.....33
Du Pont de Nemours & Co., E. I., Wilmington, Del.....25
Duriron Company, Dayton, Ohio.....—

Fairlie, Andrew M., Atlanta, Ga.....29
Farmers Fertilizer Co., Columbus, Ohio...34
Freeport Sulphur Co., New York City....—

Gascoyne & Co., Inc., Baltimore, Md.....34

Hayward Company, The, New York City..34
Huber Co., L. W., New York City and Jersey City, N. J.....26
Hydrocarbon Products Co., New York City.17

International Minerals & Chemical Corporation, Chicago, Ill.....23

Jeffrey Manufacturing Co., The, Columbus, Ohio.....—
Jett, Joseph C., Norfolk, Va.....—

Keim, Samuel D., Philadelphia, Pa.....33

Link-Belt Company, Chicago, Ill.....—

McIver & Son, Alex. M., Charleston, S. C..22

Monarch Mfg. Works, Inc., Philadelphia, Pa.....34

Pacific Coast Borax Co., New York City..—
Phosphate Mining Co., The, New York City..... 4
Polk Co., R. L., Detroit, Mich.....—
Potash Co. of America, New York City. 3rd Cover

Ruhm, H. D., Columbia, Tenn.....34

Sackett & Sons Co., The A. J., Baltimore, Md.....—
Schmaltz, Jos. H., Chicago, Ill.....34
Shuey & Company, Inc., Savannah, Ga...34
Smith-Rowland Co., Norfolk, Va.....—
Southern Phosphate Corp., New York City..20
Stedman's Foundry and Machine Works, Aurora, Ind.....24
Stillwell & Gladding, New York City.....34
St. Regis Paper Co., New York City Back Cover
Synthetic Nitrogen Products Co., New York City.....—

Tennessee Corporation, Atlanta, Ga.....22
Texas Gulf Sulphur Co., New York City..34
Textile Bag Mfrs. Association, Chicago, Ill..—

Union Bag & Paper Corp., New York City.—
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.....27
United States Potash Co., New York City.19

Virginia-Carolina Chemical Corp., Mining Dept., Richmond, Va.....—

Wellmann, William E., Baltimore, Md....27
Wiley & Company, Inc., Baltimore, Md...34

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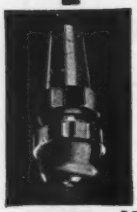

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See Catalog 6-C

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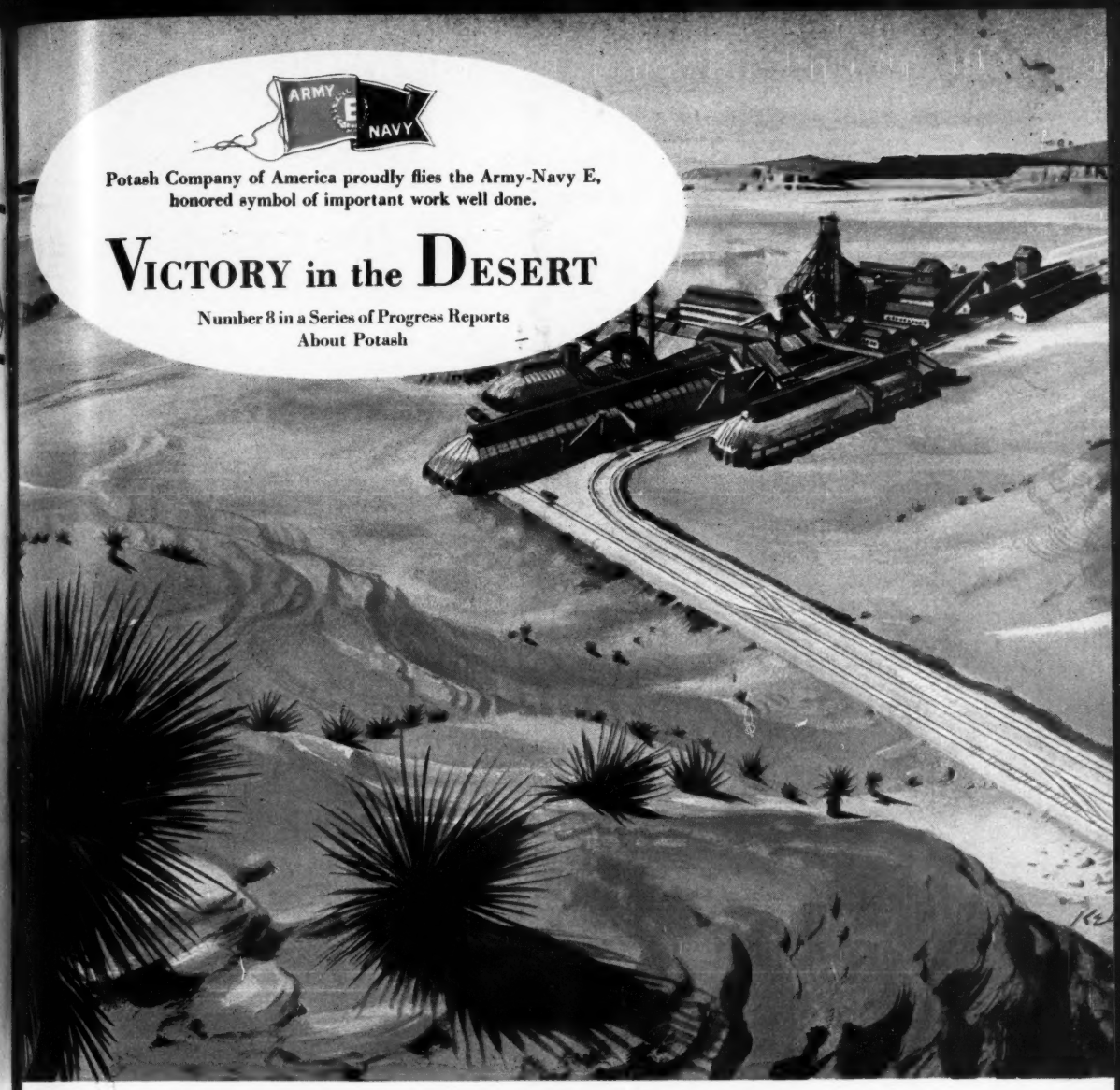

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Number 8 in a Series of Progress Reports About Potash

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It is hard to believe that under this parched area of New Mexico are large deposits of a substance vital to agriculture and to industry — Potash.

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